DESERT ROSES – A CRYSTAL MORPHOLOGICAL STUDY

PAPP, R.[1]*, TÓTH, E.[2], BENDŐ, Zs.[3] & WEISZBURG, T.G.[1]
[1] Department of Mineralogy, Eötvös Loránd University, Pázmány P. sétány 1/C, H-1117 Budapest, Hungary
[2] Eötvös Museum of Natural History, Eötvös Loránd University, Pázmány Péter sétány 1/C, H-1117 Budapest, Hungary
[3] Department of Petrology and Geochemistry, Eötvös Loránd University, Pázmány P. sétány 1/C, H-1117 Budapest, Hungary
* E-mail: pappr@nhmus.hu

Desert roses are well-known crystallisation forms of the sulphates gypsum and barite: in arid climate, sulphate precipitating from evaporating fluids encloses grains of the surrounding sand. Evolved crystal groups usually consist of intergrown lens shaped "petals" or rosettes. The rosettes represent more or less simultaneous crystallisation centres that finally get connected in the course of multiple growth cycles.

Gypsum roses can be grouped according to the size and arrangement of the rosettes. Up to now, African gypsum samples have been studied in details, and three morphological groups have been distinguished. The first type is characterised by the presence of a big, central rosette and the other rosettes grow out from the middle of the central petal. At the second type plates grow randomly, and they cross other rosettes on many places. At both types, plate growth continues with the original orientation after crossing another plate, yet the growth of smaller rosettes usually stops at the contact with bigger rosettes. At the rare third type, plates do not grow through each other, but grow roughly parallel and they are only linked at the middle of the rosettes.

Gypsum roses from Chihuahua, Mexico, are spherical aggregates, built up of max. 5–6 mm long, colourless gypsum plates, and on the edge of the rosettes a white crust of anhydrite (possibly with some gypsum) is present, without any inclusions.

Many gypsum rosettes exhibit perfect cleavage, allowing a look inside the rosette. Stereomicroscopic and SEM observations suggest that the rosettes always cleave according to {010}, because we can observe two less perfect cleavage directions around the included sand grains, and the angle between these directions is close to 118.43° (or the 61.57°supplementary angle), corresponding to the angle between {100} (// *c* axis) and {011} (// *a* axis) on the (010) plane. This way the crystallographic orientation of the rosettes can be identified. Cleavage according to $\{11\bar{1}\}$ and $\{\bar{1}03\}$ (HINTZE, 1930) has not been observed on the desert rose samples.

Concerning the orientation of the rosettes (hypidiomorphic single crystals), the (010) plane is always perpendicular to the equatorial plane (the biggest circle cross section) of the rosette, the crystallographic axis *b* always being in the equatorial plane.

Gypsum roses can further be categorised upon their sand content: they can be rich or poor in sand grains. In the sand-poor rosettes, sand grains are aligned into growth zones. The middle of the rosette is mostly clear and inclusion-free, then towards the rim of the rosettes sand-rich zones alternate with clear, sand-free zones. Growth cycles probably start in a loose sandy environment, clear gypsum crystallising first, with the sand grains being pushed away from the growing crystal face, and subsequently, as the sand grains around the growing crystal get more closely packed, the crystal finally incorporates them. The growth zones usually have approximately rhombic cross section on the (010) plane, and the sand lanes run roughly parallel to the edges of the lens. The surface of the gypsum rosettes is uniformly coated with sand grains, and sand grains are accumulated at the connection zones of the rosettes.

Inclusion zones and perfect (010) cleavage are missing from the sand-rich rosettes. Inclusion zoning depends on the grain size of the sand, too: if the grains are larger than 2–3 mm, the gypsum simply grows around the grains, without forming grain-rich and grain-free growth zones.

Scanning electron microscopy equipped with energy-dispersive X-ray spectrometer (SEM-EDX) was applied for the identification of sand grains. More than 90% of the inclusions are quartz and alkali feldspar, but occasionally amphibole, TiO_2, iron (oxy)hydroxide, titanite, garnet, calcite, and zircon grains were identified, too.

Barite roses studied so far were full of sand and because of that we did not manage to make good cleavage planes on the petals. At some cases, at the edge of the rosettes and at the connection zone between petals, sand grains were aggregated by clay.

Reference

HINTZE, C. (1930): Handbuch der Mineralogie, 1.3.2., pp. 4274–4323.